REMARKS/ARGUMENTS

Status of the Application

The status of the application is as follows:

- Claims 1-20 are pending.
- Claims 14 and 17 are objected to due to minor informalities.
- Claims 1-4, 9, 11-16, and 20 stand rejected as obvious over Van Eijk in view of Boerner.
- Claims 7 and 8 stand rejected as obvious over Van Eijk and Boerner, and further in view of Tonami.
- Claims 14-16 stand rejected as obvious over Van Eijk and Boerner, and further in view of Juestel.
- Claim 17 stands rejected as obvious over Van Eijk, Boerner, and Juestel, and further in view of Tonami.
- Claims 18 and 19 stand rejected as obvious over Van Eijk and Boerner, and further in view of Juestel.

Claim Objections and Amendments

Claims 14 and 17 are objected to due to minor informalities, which have been corrected as suggested by the Examiner. Entry of these amendments is requested as their entry does not impose an additional burden on the Examiner and the amendments place the application in better condition for allowance or appeal.

Regarding the material $Ca_{1-2y}Li_2SiO_4{:}Pr_yNa_y$ set out in claim 14, the Examiner's attention is directed to page 6, line 8 of the application as filed.

The Cited References

Van Eijk, et al.

Van Eijk is directed to scintillators having extremely fast response times. Example applications noted by van Eijk include the suppression of random coincidences in positron emission tomography (PET), the observation of extremely short positron lifetimes in positron lifetime modeling (PLM), and physics and other applications that require high count rates and/or the suppression of random coincidences.[1] As can be seen in Table I, suitable decays times are on the order of about <1 ns to roughly 100 ns.

At page 685, first column, van Eijk surveys the available scintillators. He concludes that a first group of scintillators has suitable light yields, but unacceptably long decay times – greater than about 200nS. A second group of scintillators have acceptable decay times – in the range of about 1-30 ns – but poor light yields. Van Eijk thus states the basic problem:

> A scintillator that meets the basic requirement of both a fast response and a high light yield *is not found*. In consequence of this an increasing number of groups is *performing research* to find new inorganic scintillators with an emphasis on a high light yield and a short decay time.

(emphasis added). Following a discussion of the theoretical underpinnings of scintillator performance, van Eijk's Conclusion section states as follows:

> There is strong interest in new fast inorganic scintillators. At present the emphasis of scintillator research is on 5d – 4f transitions of Ce^{3+} doped materials. Yet, Nd^{3+} and *Pr^{3+} doped scintillators could also be of interest. Although real high light yields have not been observed,* the cases of $Y_3Al_5O_{12}$:Pr and $YAlO_3$:Pr, which have a time response faster than that of Ce, *are stimulating further research.*

(emphasis added).

[1] van Eijk at Abstract, page 64 second column, and Table 1.

Thus, van Eijk emphasizes the performance requirements of high light yields and extremely short decay times, as well as the need for further research to identify scintillator materials that might possibly satisfy these requirements.

At the end of page 664 bridging to page 665, van Eijk teaches that the need to match the scintillator emission wavelength to existing light sensors such as photomultiplier tubes (PMs) and photodiodes limits the choices for scintillator materials to those which produce light in the visible light range. In view of the UV emission wavelengths of van Eijk's proposed, experimental scintillators, van Eijk eschews the use of PMs or photodiodes and instead teaches that wire chambers and gas-filled microstrip chambers should be used instead:

> It should be pointed out that wire chambers and gas-filled microstrip chambers with TMAE or CSI photocathodes are sensitive for wavelengths $\lambda < 200$ nm.

That van Eijk teaches the use of such photodetectors is further emphasized at page 666:

> In addition to faster response, a large 5d – 4f energy difference has the advantage that light-sensitive wire chambers and micro-strip chambers can be used.

Thus, van Eijk proposed detector includes a Pr^{3+}-activated scintillator and wire strip or micro-strip chambers, and not a photodiode as required by the present claims.

<u>Boerner</u>

The Boerner reference is directed to an x-ray detector used in low speed applications such as x-ray photography or x-ray fluorochemical analysis. As discussed in Boerner, x-rays passing through the human body or other material are detected and processed to make a digital image. However, the exposure times and detector speed requirements of such applications are orders of magnitude less that those addressed van Eijk. In the case of medical imaging, for example, a relatively fast physiological motion is that of the heart, which beats on the order of one or two times per second.

Claim Rejections 35 USC 103

Claim 1

Claim 1 is directed to a device that requires, among other things, a Pr^{3+} activated scintillator for converting input radiation into UV radiation, a color converter which contains a luminous substance for converting the UV radiation into an optical signal, and a photodiode which converts an optical signal to an electrical signal.

The Office Action asserts that Van Eijk discloses the claimed scintillator and photodiode. The Office Action concedes that Van Eijk does not disclose a color converter, but cites Boerner to remedy this deficiency. The Office Action asserts that Boerner teaches a scintillator layer that emits radiation bordering the UV region around 400 nm and uses a color transforming layer to convert the emitted radiation to a wavelength more suited to the spectral sensitivity of the detector. The Office Action further asserts that, since Boerner relies on the basic teaching of photoluminescence to convert light of a higher energy (such as UV) to a lower energy (such as visible), the wavelengths taught by Boerner are irrelevant.

In the Response to Arguments section, the Office Action also asserts that one using Boerner's color converter in Boerner's x-ray detection application would transform a color from the scintillator to the visible. The Office Action further asserts that, if one were to use Boerner's color converter with the scintillator of Van Eijk, it would be necessary to convert light from Van Eijk's scintillator to the visible range. In this regard, the Office Action notes that Van Eijk's YPO_4:Pr scintillator emits light at about 232-272 nm (UV). The Office Action also asserts that Applicant's argument fails to consider the application of the color converter for x-ray detection as taught by Boerner, thus making it necessary to convert from the UV to the visible range.

Consequently, the Office Action concludes that the invention of claim 1 is obvious. This conclusion is respectfully traversed.

First, it is submitted that the Office Action fails to establish a *prima facie* case of obviousness because the references, when combined as suggested by the Office Action, fail to teach each and every element of claim 1.

As noted above, claim 1 requires a Pr^{3+} activated scintillator and a photodiode. The Office Action asserts that van Eijk discloses a detector including a Pr^{3+} activated scintillator and a photodiode to convert the optical signal from the scintillator. This assertion is respectfully traversed.

More specifically, the van Eijk teaches that photodiodes can be used with conventional scintillators that produce light in the visible range. In the case of van Eijk's proposed experimental, Pr^{3+}-based scintillator, van Eijk specifically teaches that the detector includes wire strips or gas filled microstrips. Thus, van Eijk does not disclose or suggest a detector that employs Pr^{3+}-based scintillator and a photodiode. As a result, the present rejection should be withdrawn.

It is also submitted that the Office Action fails to present a *prima facie* case of obviousness because one skilled in the art would not be motivated to combine the references as suggested by the Office Action. More specifically, the Office Action states that one would be motivated to use Boerner's color converter to convert the radiation from the scintillator to a wavelength more suitable for the spectral sensitivity of the photodiode.

As noted above, van Eijk has *already solved* the wavelength matching problem resulting from the use of the Pr^{3+}-based scintillators through the use of wire strip or gas filled microstrip detectors. As the problem has already been solved by the explicit teachings of van Eijk, there is no motivation or suggestion to solve a non-existent problem. Stated another way, Boerner's color converter would serve no purpose in van Eijk's detector, which is already color matched. Viewed from still another perspective, one skilled in the art would have not reason to consider van Eijk's conjectural, high speed scintillator material for use in the detector of Boerner.

Indeed, it is submitted that purported motivation results from an impermissible hindsight reconstruction based on the teachings of the present application, as van Eijk's device simply does not have the asserted wavelength matching problem that is the basis for the purposed motivation to combine the detector of van Eijk with the color converter of Boerner.[2]

The rejection is also premised on an impermissible "obvious to try" rationale. However, obvious to try is not the appropriate legal standard. More specifically, and as also summarized at MPEP 2145.X.B, the Federal Circuit has held that the "obvious to try" rationale is erroneous in at least two circumstances:

- Where it would be obvious to try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful; or

- Where what was obvious try was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.[3]

It is submitted that both of these situations apply to the present application. Van Eijk merely suggests that Pr^{3+} doped detectors are a promising field of experimentation, even though van Eijk acknowledges that the Pr^{3+}-based scintillators cited in his Conclusion section have not yet been observed to produce high light yields. In the case of the YPO_4:Pr scintillator mentioned in the present Office Action (which is not mentioned in van Eijk's conclusion as being a promising field of inquiry), van Eijk does not even present light yield or decay time data. Providing at most general guidance as to a field of inquiry – and acknowledging that the desired light yield characteristics have not yet been observed – van Eijk teaches at most that it *may be possible* to produce a

[2] *See* MPEP 2145.X.A.
[3] *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988), *Pfizer v. Apotex*, 480 F.3d 1348 (Fed. Cir. 2007); MPEP 2145.X.B.

scintillator having the requisite performance characteristics. Such is not the standard for obviousness.[4]

For at least the foregoing reasons, withdrawal of the rejection of claim 1 is respectfully requested.

Claims 9 and 10

The foregoing remarks apply, *mutatis mutandis*, to **claims 9 and 10**.

Claims 2 and 14-16

Dependent **claims 2** and **14-16** recite various scintillator materials.

In rejecting these claims, the Office Action asserts that van Eijk teaches the scintillator compounds of YPO_4:Pr and Y_2SiO_5:Pr (Table 2). The Office Action asserts that these are members of the claimed group, with x=1.

These compounds are not recited in any of claims 2 and 14-16, with x=1 or otherwise. Applicant believes that the Examiner has misread the claims. Hence the rejection of these claims as obvious over van Eijk in view of Boerner should be withdrawn.

The Examiner is invited to contact the undersigned if there is further confusion in this regard.

[4] MPEP 2145.X.B.

Claims 15 and 16

Claim 15 is directed to a sensor including a Pr^{3+} activated scintillator including $LaPO_4$:Pr that converts input radiation into UV radiation. **Claim 16** is similar, requiring that the Pr^{3+} activated scintillator include one of $LuCl_3$:Pr, $LuBr_3$:Pr, $(Lu_{2-x}Y_x)SiO_5$:Pr, where $0 \leq x \leq 1$, $(Lu_{1-x}Y_x)Si_2O_7$:Pr, where $0 \leq x \leq 1$, and $(Lu_{1-x}Y_x)BO_3$:Pr, where $0 \leq x \leq 1$.

The Office Action concedes that $LaPO_4$ an $LuBO_3$:Pr are not disclosed in van Eijk and Boerner and cites Juestel to remedy the deficiency, stating that these materials would be an obvious alternative to the materials of van Eijk.

This assertion is respectfully traversed. Juestel is directed to mercury discharge lamps. The materials suggested by Juestel are used to convert mercury radiation in the "high energy" ultraviolet (VUV) range (*i.e.*, having a wavelength of about 185 nm) to relatively longer wavelength UV radiation. Van Eijk, on the other hand, is directed to detectors used to detect high energy ionizing radiation. From the perspective of van Eijk, "low" energy is in the range of hundreds of keV.[5]

It is submitted that the use of the materials suggested by Jeustel in the detector of van Eijk is not a matter of simple substitution as suggested by the Office Action. While Juestel indicates that its proposed materials may be sensitive to UV radiation produced by a gas discharge lamp, there is no teaching or suggestion that such materials would be suitable for converting high energy input radiation in the high speed radiation detector of van Eijk. As a still further example, while Juestel mentions an emission quantum yield on the order of 90% in the UV range, it is silent as to the light yields at the energy ranges of interest to van Eijk. Indeed, the scintillator light yield at these high energies is one of the central questions that, according to van Eijk, requires still further experimentation and research to resolve.

[5] van Eijk page 665.

At most, the Office Action asserts that the suggested materials are known and that it would obvious to try them. However, such is not the standard for obviousness. AS recognized by the Supreme Court in *KSR v. Teleflex*:

> *[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.* Although common sense directs one to look with care at a combination of two known devices *according to their established functions*, it can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely on building blocks long since uncovered, and claimed discovers almost of necessity will be combinations of what, in some sense, is already known.[6]

In the present case, the Juestel reference relied on by the Office Action establishes, at most, that the claimed substances were known. Moreover, this is not a situation in which the devices are combined according to their established functions – the Jeustel references describes the use of the materials to convert UV radiation in gas discharge lamp applications. The present claims, on the other hand, utilize the materials in an entirely different function.

Moreover, and as noted above, the Federal Circuit has held that the "obvious to try" rationale is erroneous in at least two circumstances:

- Where it would be obvious to try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful; or

- Where what was obvious try was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.[7]

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[6] *KSR. International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, (2007), slip op. at 14-15 (emphasis added).
[7] *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988), *Pfizer v. Apotex*, 480 F.3d 1348 (Fed. Cir. 2007); MPEP 2145.X.B.

This line of reasoning was recently seconded in *KSR v. Teleflex*, where the Supreme Court recognized that an "obvious to try" rationale may apply where "there are a *finite number* of *predictable* solutions."[8]

It is submitted that both of these situations apply to the present application. As noted above, van Eijk simply suggests that Nd^{3+} and Pr^{3+} doped scintillators "could be of interest" and are "stimulating further research." To the extent that van Eijk provides any guidance for which materials may be successful avenues for research, such guidance is specifically limited to two materials – $Y_3Al_5O_{12}$:Pr and $YAlO_3$:Pr, neither of which is germane to the present claim. Still further, the experimental nature and uncertainty inherent – even for the suggested materials -- in such an endeavor is highlighted by van Eijk himself, who pointedly and specifically observes that the requisite "high light yields have not yet been observed."

Moreover, Juestel simply lists a large number of materials having properties that are apparently suitable for use in a gas discharge lamp application that requires sensitivity to UV radiation, and provides no indication whatsoever that those materials might have properties suitable for use in the detector of van Eijk.

Hence, the rationale set out in the office action would require one to try each of these many choices until one possibly arrives at a suitable outcome, all in an upredicatable field that is acknowledged by van Eijk to require further research and in which the required characteristics have not yet been observed. Such is not the standard for obviousness.

<u>Claim 14</u>

Regarding **claim 14**, the Office Action acknowledges that the claimed materials are not disclosed in the cited references. Hence, the Office Action has failed to establish a *prima facie* case of obviousness.

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[8] *KSR. International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, (2007), slip op. at 17 (emphasis added).

The Office Action seeks to remedy this deficiency by stating that it would still be "obvious to try" combinations not even disclosed in the references. The remarks set forth above in connection with claims 15 and 16 apply, *mutatis mutandis*, to claim 14.

Claim 17

Claim 17 stands rejected as obvious over van Eijk, Boerner, and Juestel, and further in view of Tonami.

The remarks presented above with respect to claims 1, 2, and 14-16 apply, *mutatis mutandis*, to claim 17.

Other claims

Dependent claims not specifically addressed above are believed to be directed to allowable subject matter at least by virtue of their dependence from their respective base claims.

Conclusion

In view of the foregoing, it is submitted that claims 1-20 distinguish patentably and non-obviously over the prior art of record. An early indication of allowability is earnestly solicited.

Respectfully submitted,

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